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*V. Part of two Letters from Mr Anthony Van
Leewenhoek, F. R. S. concerning Worms pre-
tended to be taken from the Teeth.*

Delph in Holland, July 27, 1700.

S I R,

YOur most acceptable Letter, dated *July 4.* old stile, came to hand on the 19th of the same month, new stile: upon the receipt whereof, I immediately open'd the piece of black Silk contain'd within it, where I found two little Worms dead, and one alive, which were sent you to be convey'd to me, as being taken out of a corrupt Tooth by smoaking.

Immediately I made it my business to find out what sort of Worms they were, and how they were generated.

I had not spent much time upon the living Worm, which wanted above one half of its full growth, when I concluded that it sprung from the Egg of a small Fly, of that sort of Flies that frequent Cheesemongers Shops for the most part, and have a peculiar humour of laying their Eggs upon Cheese: now the Worms taking their rise from those Eggs, bore through the Cheese, and take their nourishment and growth from it; and afterwards become little Flies again. When these little Worms arrive at such a bulk as is discernible by the naked eye, we call 'em Worms.

I took a Glass Tube, one end whereof was blown together, it being somewhat more than a finger long,

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and about half an Inch wide ; and put into it the living Worm, together with some crums of very old and fat Cheefe, in order to try if the Worm feeding upon the Cheefe would come to its full growth.

I stopp'd the Glas with a Cork; for I am positive that a Worm may live and grow in a Glas as well as in a firm Cheefe cover'd up all about.

Being confident that both the dead Worms and the living one were of the above-mention'd sort, I got a Cheefemonger to single out that sort of old Cheefe, and bring some of its little Worms to my house.

I put 6 or 8 of the greatest of these Worms in two distinct little Glasses, together with one of the dead Worms you sent me, designing to compare the living and dead Worms before a Magnifying-Glas: and could not descry the least difference either in the Head or the whole Body.

When these Worms had been shut up 5 days without any food, I observ'd 'em gnawing the Corks that stopp'd the Glasses. Then I put in a little Cheefe, that if they did not arrive at their full Growth, they might not want Food, in order to their change into Flies.

I likewise endeavour'd to bring one of these Worms to an extended and quiet posture, in order to view the internal parts; which succeeded with me several times: and so I saw to my great admiration such moving instruments all over the Body within, that not one of a thousand would be perswaded to believe, that in such a contemptible Insect there is so much to be seen: for in one place I thought I saw the motion of the Heart, and not far from that the motion of the Stomach: But after all the narrowest enquiry, I could not descry any motion in the Blood in those parts which I took for Veins. If one of these Worms were cut up, and its Bowels presented to view, they'd pre-
sent:

sent you with an astonishing number of Vessels, which appear'd to me like Blood Vessels.

I would fain know what food these Creatures live upon, besides Cheese; in the first place, because I never yet saw 'em any where else but in Cheese; and in the next place, because they cannot arise from Flesh; for the Worms that spring from the Eggs of Flies in Flesh, which we also call Mites or Fly-bows, are fully grown in the space of nine days; but those which feed upon Cheese require a longer time for compleating their growth, and Flesh will not keep so long without Salting or Smoaking.

Since things stand thus, we must conclude that it is always natural to these little Flies to lay their Eggs upon such substances as will not easily corrupt; now we may justly reckon Cheese to be such.

Let's imagine that the Patient, whose Tooth threw out the Worms by Smoaking, had some time before eaten Cheese laden with young Worms, or Eggs of the above-mention'd Flies, and that these Worms or Eggs were not touch'd or injur'd in the chewing of the Cheese, but stuck in the hollow Teeth, and at last insinuated themselves so far into the substance of the Teeth, that they gnaw'd the sensible parts, and so occasion'd the great pain.

It appears very strange to me, that smoak in the Mouth or Tooth should have such an effect, as to bring Worms out of hollow Teeth; for I cannot conceive how the little Worms should have a respiration, to be so far prejudic'd by the Smoak, that they are obliged to come forth.

To satisfy my self upon this point, I took a Glass Ball, the Diameter whereof was almost three inches, with a little hole in it as large as the thickness of a Goose Quill. In this Glass I put ten Cheese-worms of the largest sort and twice or thrice threw in burning

Brimstone, to the breadth of the back of a Knife, upon a thin slender peice of Hemp ; and observed that the burning Brimstone did not at all injure the Worms, so far as I could see ; and about an hour after the burning of the Sulphur, I put the mouth of the Glass to my Nose, and could still plainly perceive the smell of the Sulphur.

'Tis well known that when we burn Sulphur, the Sulphur does not perish, but only is divided into such small particles, as are remov'd from our view : and accordingly in this experiment I saw an infinite number of very small sulphureous particles, sticking to the inside of the Glass, which appeared to me to be round.

I have often fill'd such a Glass Ball with Water, and expos'd it to the rays of the Sun, (instead of a grounded Glass) which were so concentred that it burnt Paper.

I return thanks for the communication of these Worms ; especially, because heretofore several people wanted to know of me from whence they came, and added, that they did not come by generation, but started up of themselves ; the contrary of which must be looked upon as a certain truth.

The living Worm that you was so kind as to send me, I have kept still alive, and cannot but think that 'tis become bigger since I had it. I'll try to bring it up so far, till it turns into a Fly.

These Worms have a hard and strong skin, and may last a long time.

I remember, some years ago my late Wife being much afflicted with the Tooth-ach, complain'd that the pain was such, as if the Flesh had been gnaw'd through.

Having called a Doctor of Physick oftner than once, a great many Remedies were try'd to no purpose : at last she found benefit by dropping the Oyl of Vitriol into

into the hollow Tooth, which I did with a Glass Instrument, that convey'd the Oyl to the Tooth without injuring the Muscles.

Now it's possible she might have got one or more of these little Worms in the hollow Tooth, at a time when she eat heartily of old Cheese, which was seiz'd with whitish rottenness, and had a great many little Worms in it, which she did not observe, tho she fed often upon it. Upon this supposition the pain might be occasion'd by those Worms, which were afterwards kill'd by the Oyl of Vitriol when we knew nothing of 'em.

You acquaint me that the generation of Living Animals in the Male Seed, is one of the abstrusest points of Philosophy, and that a further enquiry into that matter would be serviceable both to the Royal Society and the Learned World.

This I do not think strange, since all new advances are offensive, especially upon a point where much is written, and many mistakes committed ; some being over-born with prejudice, and others so influenc'd by their teachers, that there's no bringing them off from their receiv'd opinions. However, I am glad, that I have the Letters of Learned men to vouch, that others are guilty of many errors, where I have spoken nothing but the truth.

I have some thoughts of pursuing that matter, and if I meet with any thing uncommon, I shall acquaint you with it.

Delph in Holland, Sept. 7. 1700.

Sir,

IN my last of the 27th of *July*, I acquainted you that I had taken several Worms of Cheefe, shut them up in a glass Tube, and smoakt them with Brimstone, which Mites or Maggots (except one that was not come to its growth) were in a few days changed into *Tonnekens* or *Cales*, and from thence into Flies, that died after 4 or 5 days ranging about their Glass Vessel.

I cleansed the Tube of the Excrements of those Flies, and imagining that they were dead for want of Food, I put a bit of Cheefe into it, and afterwards shifted other Flies of the same nature out of a wooden Box, where I kept them, into my Glass Tube.

I had no sooner put them into the aforesaid Tube, but they presently proceeded to Copulation, and remained near 15 minutes in that posture; nay, I have seen some Flies, as soon as ever they came out of their *Dop*, and when their *Wicken* was hardly stretcht out the half of its length, go immediately to coupling; and as soon as they had done, others of the Male kind would attempt to succeed them, and joyn with the same Female, which she would never suffer, but continue moving the hinder part of her Body till the other quite desisted.

These Flies on the 29th of *August* were 8 in number. I observed them daily, in order to discover their Eggs, and at the said time, that they had laid several of their longish Eggs against the side of the little piece of Cheefe.

Hence it appeared, that these Flies could not subsist without Food, for there was abundance of Excrements
on

the sides of the Glais, and the Flies were as brisk again, as when they came out of their *Tonnekens* first.

On the 31st of *August*, the Eggs were twice as many as before, and I saw two small Worms creep out of the Eggs that stuck against the Cheese.

On the 1st of *September* I could perceive no more Worms at first, but looking more narrowly I found that some of them had already buried themselves in the Cheese, and others stuck with their Bodies half in and half out.

This insinuation of their Bodies into soft Cheese may easily be accounted for, they being arm'd with two little Teeth upon their head, which if they do not use them, are sheathed in the same.

The Bodies of these Creatures when they came out of their Eggs were not larger then so many Grains of small Sand, but at present are so encreased, that some of them are near four times as long, and proportionably big, and now most of the Flies are dead.

The Worm which you sent me, and that was still alive, I put into a Glais hermetically seal'd at one end, and stop't with a Cork at t'other, after that I had convey'd into it a bit of Cheese, that the Worm might come to its full growth and change.

At the end of fourteen days I observed it was changed into a *Tonneken*, though it did not seem to be arrived at its full growth, which made me believe it would never be a Fly; but I was mistaken, for soon after I spied the Fly leaping about the Glais, and the empty *Tonneken* by it.

I take the liberty to send you the said dead Fly, and the *Tonneken* inclosed in Numb. 1.

In Numb. 2. are several empty *Tonnekens*, and the Flies that came out of them, all which proceeded from
Mites

Mites that one of our Cheesemongers helpt me to, and and by comparing yours and mine together , you will easily observe that they are alike in all their parts.

I shall break off here, after having presented my most humble service to the Members of the Royal Society, and remain,

Sir,

Your most humble Servant,

Anthony Van Leeuwenhoek.